# 4.2 Apply Congruence and Triangles

**Goal** • Identify congruent figures.

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<u>Congruent figures-</u>All of the parts of one figure are congruent to the corresponding parts of the other figure

*In congruent polygons, this means that the *corresponding sides and corresponding angles are congruent*

**Congruent**

Same size and shape

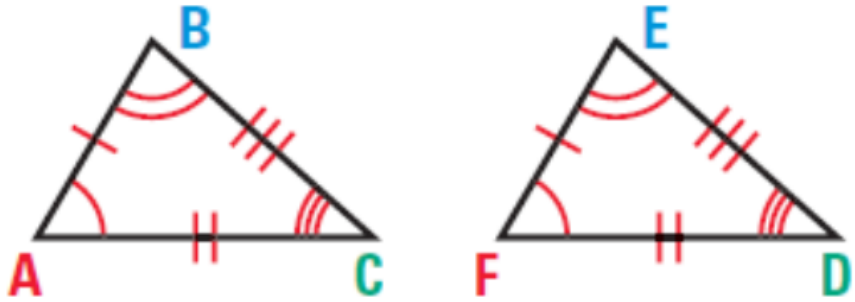
**Not congruent**

Different sizes or shapes

## Congruence Statements

When you write a congruence statement for two polygons, ALWAYS list the corresponding vertices in the same order.

(You can write the congruence statements in more than one way.)



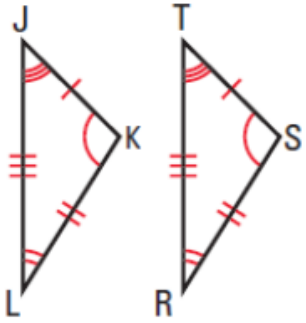

$\triangle ABC \cong \triangle FED$ or $\triangle BCA \cong \triangle EDF$.

| | | | |
|---|---|---|---|
| **Corresponding angles** | $\angle A \cong \angle F$ | $\angle B \cong \angle E$ | $\angle C \cong \angle D$ |
| **Corresponding sides** | $\overline{AB} \cong \overline{FE}$ | $\overline{BC} \cong \overline{ED}$ | $\overline{AC} \cong \overline{FD}$ |

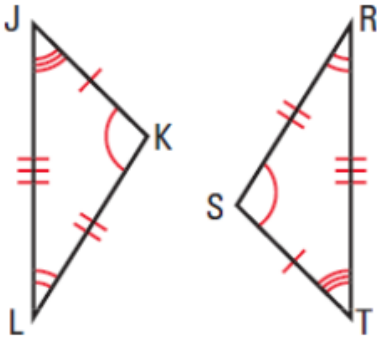
## EXAMPLE 1 Identify congruent parts

**VISUAL REASONING**

To help you identify corresponding parts, turn $\triangle RST$.




**Write a congruence statement for the triangles. Identify all pairs of congruent corresponding parts.**

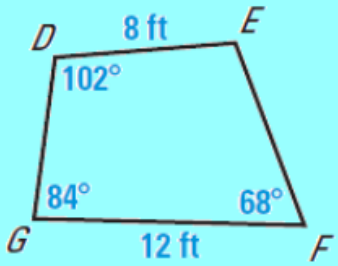


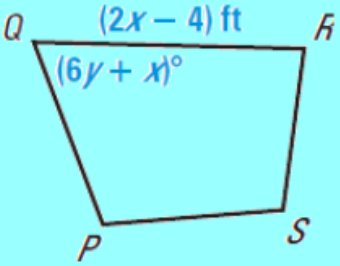
## EXAMPLE 2 Use properties of congruent figures

**In the diagram, *DEFG* ≅ *SPQR*.**

**a.** Find the value of $x$.

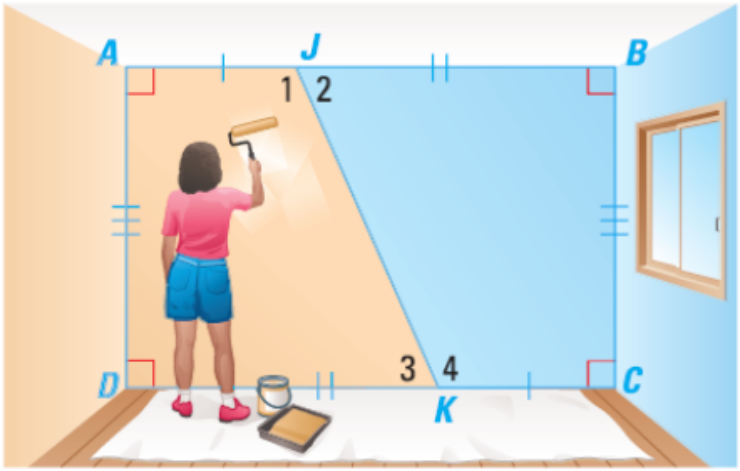
**b.** Find the value of $y$.



## EXAMPLE 3 Show that figures are congruent

**PAINTING** If you divide the wall into orange and blue sections along $\overline{JK}$, will the sections of the wall be the same size and shape? *Explain*.



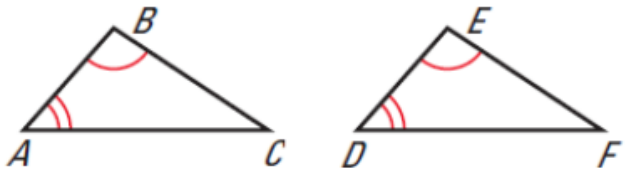
## THEOREM

*For Your Notebook*

### THEOREM 4.3 Third Angles Theorem

If two angles of one triangle are congruent to two angles of another triangle, then the third angles are also congruent.

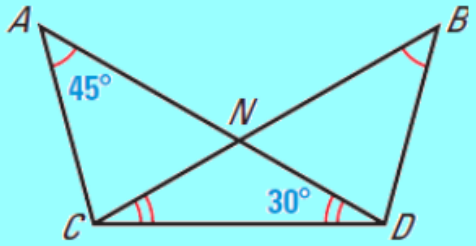
*Proof:* Ex. 28, p. 230




**If $\angle A \cong \angle D$, and $\angle B \cong \angle E$, then $\angle C \cong \angle F$.**

## EXAMPLE 4 Use the Third Angles Theorem

Find $m\angle BDC$.




**Solution**

**ANOTHER WAY**

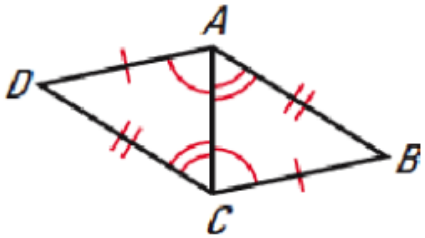
For an alternative method for solving the problem in Example 4, turn to page 232 for the **Problem Solving Workshop**.

## EXAMPLE 5 Prove that triangles are congruent

**Write a proof.**

**GIVEN** ▶ $\overline{AD} \cong \overline{CB}$, $\overline{DC} \cong \overline{BA}$, $\angle ACD \cong \angle CAB$, $\angle CAD \cong \angle ACB$

**PROVE** ▶ $\triangle ACD \cong \triangle CAB$




S

R

*The properties of congruence that are true for segments and angles are also true for triangles.

**THEOREM** *For Your Notebook*

**THEOREM 4.4 Properties of Congruent Triangles**

**Reflexive Property of Congruent Triangles**

For any triangle $ABC$, $\triangle ABC \cong \triangle ABC$.


**Symmetric Property of Congruent Triangles**

If $\triangle ABC \cong \triangle DEF$, then $\triangle DEF \cong \triangle ABC$.

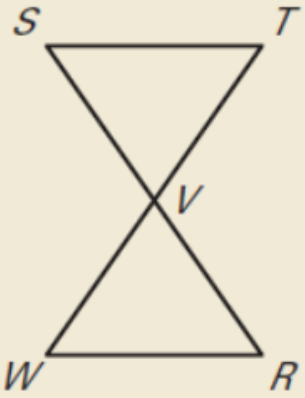

**Transitive Property of Congruent Triangles**

If $\triangle ABC \cong \triangle DEF$ and $\triangle DEF \cong \triangle JKL$, then $\triangle ABC \cong \triangle JKL$.

Write a proof for the following.

Given: $\overline{SV} \cong \overline{RV}$, $\overline{TV} \cong \overline{WV}$, $\overline{ST} \cong \overline{RW}$, $\angle T \cong \angle W$

Prove: $\triangle STV \cong \triangle RWV$




| S | R |
| --- | --- |

# Day 1 Assignment:

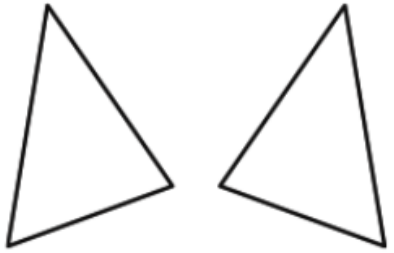
4.2 ws

LESSON 4.2

# Practice B

*For use with pages 225–231*

**1.** Copy the congruent triangles shown at the right. Then label the vertices of your triangles so that $\triangle AMT \cong \triangle CDN$. Identify all pairs of congruent corresponding angles and corresponding sides.



**In the diagram, $\triangle TJM \cong \triangle PHS$. Complete the statement.**

**2.** $\angle P \cong$ ?

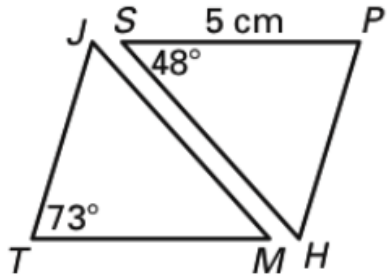
**3.** $\overline{JM} \cong$ ?

**4.** $m\angle M =$ ?

**5.** $m\angle P =$ ?

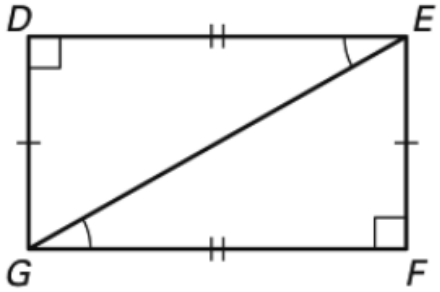
**6.** $MT =$ ?

**7.** $\triangle HPS \cong$ ?

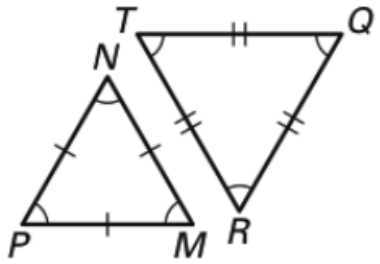


**Write a congruence statement for any figures that can be proved congruent. *Explain* your reasoning.**

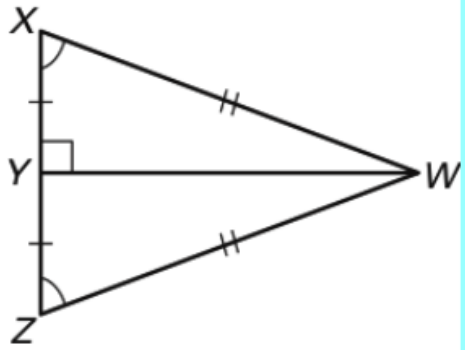
**8.**




**9.**

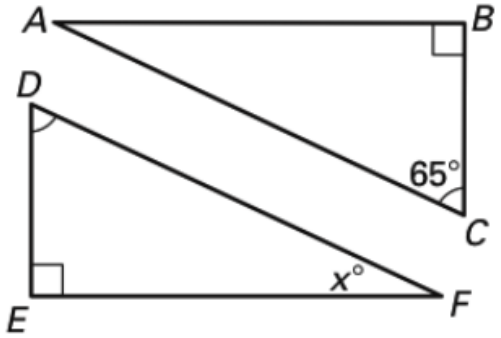



**10.**

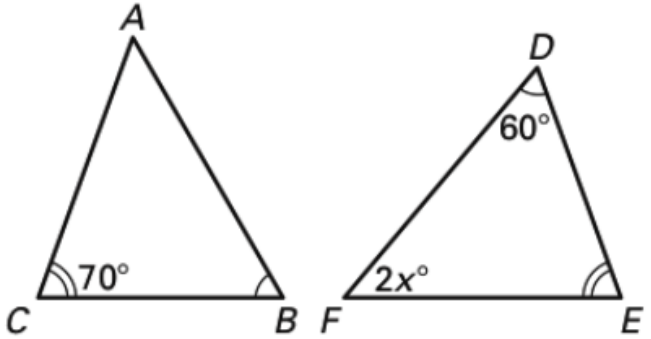



**Find the value of *x*.**

**11.**

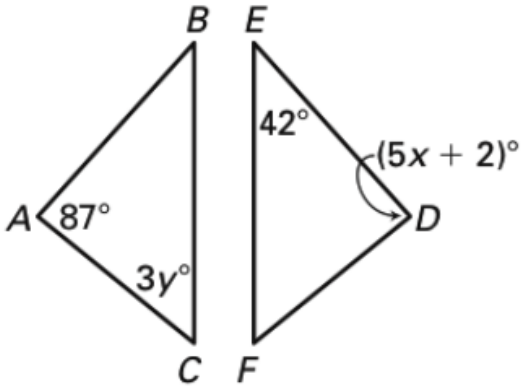



**12.**



**In Exercises 13 and 14, use the given information to find the indicated values.**

**13.** Given $\triangle ABC \cong \triangle DEF$, find the values of $x$ and $y$.

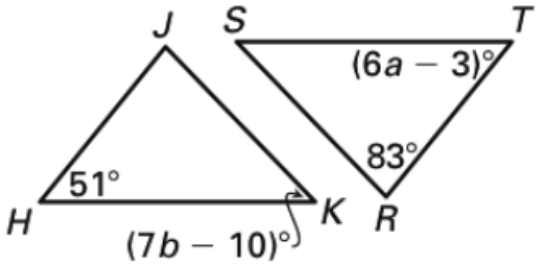


LESSON 4.2

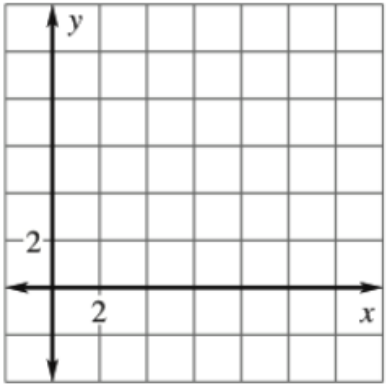
# Practice B *continued*

*For use with pages 225–231*

**14.** Given $\triangle HJK \cong \triangle TRS$, find the values of $a$ and $b$.



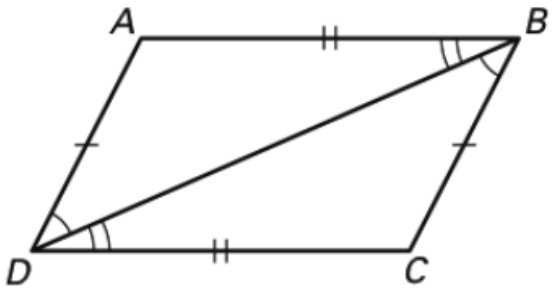

**15.** Graph the triangle with vertices $A(1, 2)$, $B(7, 2)$, and $C(5, 4)$. Then graph a triangle congruent to $\triangle ABC$.



**16. Proof** Complete the proof.

**GIVEN:** $\angle ABD \cong \angle CDB$, $\angle ADB \cong \angle CBD$, $\overline{AD} \cong \overline{BC}$, $\overline{AB} \cong \overline{DC}$

**PROVE:** $\triangle ABD \cong \triangle CDB$




| Statements | Reasons |
|---|---|
| **1.** $\angle ABD \cong \angle CDB$, $\angle ADB \cong \angle CBD$, $\overline{AD} \cong \overline{BC}$, $\overline{AB} \cong \overline{DC}$ | **1.** Given |
| **2.** $\overline{BD} \cong \overline{BD}$ | **2.** ? |
| **3.** ? | **3.** Third Angles Theorem |
| **4.** $\triangle ABD \cong \triangle CDB$ | **4.** ? |

**17. Carpet Designs** A carpet is made of congruent triangles. One triangular shape is used to make all of the triangles in the design. Which property guarantees that all the triangles are congruent?

# *Answer Key*

## *Lesson 4.2*

### Practice Level B

**1.** Check student diagram; $\overline{AM} \cong \overline{CD}$; $\overline{AT} \cong \overline{CN}$; $\overline{MT} \cong \overline{DN}$; $\angle A \cong \angle C$; $\angle M \cong \angle D$; $\angle T \cong \angle N$

**2.** $\angle T$ **3.** $\overline{HS}$ **4.** 48° **5.** 73° **6.** 5 cm **7.** $\triangle JTM$

**8.** $\triangle DEG \cong \triangle FGE$; all corresponding sides and angles are congruent.

# Day 2 Assignment:

p. 228 (3, 5-12, 15, 16, 19-21, 26, 33-40)